Wealth Accumulation, Credit Card Borrowing, and Consumption-Income Comovement

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1 Self control problems

• People are patient in the long run, but impatient in the short run.

• Tomorrow we want to quit smoking, exercise, and eat carrots.

• Today we want our cigarette, TV, and frites.
Self control problems in savings.

- Baby boomers report median target savings rate of 15%.

- Actual median savings rate is 5%.

- 76% of household’s believe they should be saving more for retirement (Public Agenda, 1997).

- Of those who feel that they are at a point in their lives when they “should be seriously saving already,” only 6% report being “ahead” in their saving, while 55% report being “behind.”

- Consumers report a preference for flat or rising consumption paths.
Further evidence: Normative value of commitment.

- “Use whatever means possible to remove a set amount of money from your bank account each month before you have a chance to spend it.”

- Choose excess withholding.

- Cut up credit cards, put them in a safe deposit box, or freeze them in a block of ice.

- “Sixty percent of Americans say it is better to keep, rather than loosen legal restrictions on retirement plans so that people don’t use the money for other things.”

- Social Security and Roscas.

- Christmas Clubs (10 mil. accounts).
An *intergenerational* discount function introduced by Phelps and Pollak (1968) provides a particularly tractable way to capture such effects.

Salience effect (Akerlof 1992), quasi-hyperbolic discounting (Laibson, 1997), present-biased preferences (O’Donoghue and Rabin, 1999), quasi-geometric discounting (Krusell and Smith 2000):

\[ 1, \beta \delta, \beta \delta^2, \beta \delta^3, \ldots \]

\[ U_t = u(c_t) + \beta \delta u(c_{t+1}) + \beta \delta^2 u(c_{t+2}) + \beta \delta^3 u(c_{t+3}) + \ldots \]

- For exponentials: $\beta = 1$
  \[ U_t = u(c_t) + \delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \delta^3 u(c_{t+3}) + \ldots \]

- For hyperbolics: $\beta < 1$
  \[ U_t = u(c_t) + \beta \left[ \delta u(c_{t+1}) + \delta^2 u(c_{t+2}) + \delta^3 u(c_{t+3}) + \ldots \right] \]
Outline

1. Introduction
2. Facts
3. Model
4. Estimation Procedure
5. Results
6. Conclusion
2 Consumption-Savings Behavior

- Substantial retirement wealth accumulation (SCF)


- Consumption-income comovement (Hall and Mishkin 1982, many others)

- Anomalous retirement consumption drop (Banks et al 1998, Bernheim, Skinner, and Weinberg 1997)
2.1 Data

<table>
<thead>
<tr>
<th>Statistic</th>
<th>$m_e$</th>
<th>$se_{m_e}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>% borrowing on ‘Visa’? ($% \text{ Visa}$)</td>
<td>0.68</td>
<td>0.015</td>
</tr>
<tr>
<td>borrowing / mean income ($\text{mean Visa}$)</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>C-Y comovement ($\text{CY}$)</td>
<td>0.23</td>
<td>0.11</td>
</tr>
<tr>
<td>retirement C drop ($\text{C drop}$)</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>median 50-59 $\frac{\text{wealth}}{\text{income}}$</td>
<td>3.88</td>
<td>0.25</td>
</tr>
<tr>
<td>weighted mean 50-59 $\frac{\text{wealth}}{\text{income}}$</td>
<td>2.60</td>
<td>0.13</td>
</tr>
</tbody>
</table>
• Three moments on previous slide (wealth, % Visa, mean Visa) from SCF data. Correct for cohort, household demographic, and business cycle effects, so simulated and empirical hh’s are analogous. Compute covariances directly.

• C-Y from PSID:
\[
\Delta \ln(C_{it}) = \alpha E_{t-1} \Delta \ln(Y_{it}) + X_{it}\beta + \varepsilon_{it} \tag{1}
\]

• C drop from PSID
\[
\Delta \ln(C_{it}) = I_{it}^{\text{RETIRE}} \gamma + X_{it}\beta + \varepsilon_{it} \tag{2}
\]
3 Model

- We use simulation framework

- Institutionally rich environment, e.g., with income uncertainty and liquidity constraints


- Gourinchas and Parker (2001) use method of simulated moments (MSM) to estimate a structural model of life-cycle consumption
3.1 Demographics

- Mortality, Retirement (PSID), Dependents (PSID), HS educational group

3.2 Income from transfers and wages

- \( Y_t \) = after-tax labor and bequest income plus govt transfers (assumed exog., calibrated from PSID)

- \( y_t \equiv \ln(Y_t) \). During working life:

  \[
  y_t = f^W(t) + u_t + \nu^W_t
  \]  

- During retirement:

  \[
  y_t = f^R(t) + \nu^R_t
  \] (4)
3.3 Liquid assets and non-collateralized debt

- $X_t + Y_t$ represents liquid asset holdings at the beginning of period $t$.

- Credit limit: $X_t \geq -\lambda \cdot \bar{Y}_t$

- $\lambda = .30$, so average credit limit is approximately $8,000 \text{ (SCF)}$. 

3.4 Illiquid assets

- $Z_t$ represents illiquid asset holdings at age $t$.

- $Z$ bounded below by zero.

- $Z$ generates consumption flows each period of $\gamma Z$.

- Conceive of $Z$ as having some of the properties of home equity.

- Disallow withdrawals from $Z$; $Z$ is perfectly illiquid.

- $Z$ stylized to preserve computational tractability.

2. Consumption flow of $\gamma H$, minus interest cost of $\eta M$, where $\eta = i \cdot (1 - \tau) - \pi$.

3. $\gamma \approx \eta \implies$ net consumption flow of $\gamma H - \eta M \approx \gamma(H - M) = \gamma Z$. We’ve explored different possibilities for withdrawals from $Z$ before.
3.5 Dynamics

- Let $I^X_t$ and $I^Z_t$ represent net investment into assets $X$ and $Z$ during period $t$

- Dynamic budget constraints:

\[
X_{t+1} = R^X \cdot (X_t + I^X_t) \\
Z_{t+1} = R^Z \cdot (Z_t + I^Z_t) \\
C_t = Y_t - I^X_t - I^Z_t
\]

- Interest rates:

\[R^X = \begin{cases} 
R^{CC} & \text{if } X_t + I^X_t < 0 \\
R & \text{if } X_t + I^X_t > 0 
\end{cases} \quad R^Z = 1\]

- Three assumptions for $[R^X, \gamma, R^{CC}]$:

  Benchmark: $[1.0375, 0.05, 1.1175]$  
  Aggressive: $[1.03, 0.06, 1.10]$  
  Very Aggressive: $[1.02, 0.07, 1.09]$
3.6 Time Preferences

- Discount function:
  \[ \{1, \beta \delta, \beta \delta^2, \beta \delta^3, \ldots \} \]

- \( \beta = 1 \): standard exponential discounting case

- \( \beta < 1 \): preferences are qualitatively hyperbolic

- Null hypothesis: \( \beta = 1 \)

\[
U_t(\{C_\tau\}_{\tau=t}^T) = u(C_t) + \beta \sum_{\tau=t+1}^{T} \delta^\tau u(C_\tau) \quad (5)
\]
In full detail, self \( t \) has instantaneous payoff function

\[
u(C_t, Z_t, n_t) = n_t \cdot \left( \frac{C_t + \gamma Z_t}{n_t} \right)^{1-\rho} - 1
\]

and continuation payoffs given by:

\[
\beta \sum_{i=1}^{T+N-t} \delta^i \left( \prod_{j=1}^{i-1} s_{t+j} \right) (s_{t+i}) \cdot u(C_{t+i}, Z_{t+i}, n_{t+i})
\]

\[
+ \beta \sum_{i=1}^{T+N-t} \delta^i \left( \prod_{j=1}^{i-1} s_{t+j} \right) (1 - s_{t+i}) \cdot B(X_{t+i}, Z_{t+i})
\]

- \( n_t \) is effective household size: adults+\((.4)(\text{kids})\)
- \( \gamma Z_t \) represents real after-tax net consumption flow
- \( s_{t+1} \) is survival probability
- \( B(\cdot) \) represents the payoff in the death state
3.7 Computation

• Dynamic problem:

\[
\max_{I_t^X, I_t^Z} u(C_t, Z_t, n_t) + \beta \delta E_t V_{t,t+1}(\Lambda_{t+1})
\]

\[s.t. \text{ Budget constraints}\]

• \(\Lambda_t = (X_t + Y_t, Z_t, u_t)\) (state variables)

• Functional Equation:

\[
V_{t-1,t}(\Lambda_t) = \{s_t[u(C_t, Z_t, n_t) + \delta E_t V_{t,t+1}(\Lambda_{t+1})] + (1-s_t)E_t B(\Lambda_t)\}
\]

• Solve for eq strategies using backwards induction

• Simulate behavior

• Calculate descriptive moments of consumer behavior
4 Estimation

Estimate parameter vector $\theta$ and evaluate models wrt data.

- $m_e = N$ empirical moments, VCV matrix $= \Omega$

- $m_s(\theta) =$ analogous simulated moments

- $q(\theta) \equiv (m_s(\theta) - m_e) \Omega^{-1} (m_s(\theta) - m_e)'$, a scalar-valued loss function

- Minimize loss function: $\hat{\theta} = \arg\min_\theta q(\theta)$

- $\hat{\theta}$ is the MSM estimator.


- Specification tests: $q(\hat{\theta}) \sim \chi^2(N-\#parameters)$
5 Results

- Exponential ($\beta = 1$) case:
  \[
  \hat{\delta} = 0.857 \pm 0.005; \quad q(\hat{\delta}, 1) = 512
  \]

- Hyperbolic case:
  \[
  \begin{cases}
  \hat{\beta} = 0.661 \pm 0.012 \\
  \hat{\delta} = 0.956 \pm 0.001
  \end{cases} \quad q(\hat{\delta}, \hat{\beta}) = 75
  \]

(Benchmark case: $[R^X, \gamma, R^{CC}] = [1.0375, 0.05, 1.1175]$)
Punchlines:

• $\beta$ estimated significantly below 1.

• Reject $\beta = 1$ null hypothesis with a t-stat of 25.

• Specification tests reject both the exponential and the hyperbolic models.
<table>
<thead>
<tr>
<th>Benchmark Model</th>
<th>Exponential</th>
<th>Hyperbolic</th>
<th>Data</th>
<th>Std err</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistic:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( m_s(1, \hat{\delta}) )</td>
<td>( m_s(\hat{\beta}, \hat{\delta}) )</td>
<td>( \hat{\beta} = .661 )</td>
<td>( \hat{\delta} = .956 )</td>
<td>( m_e )</td>
</tr>
<tr>
<td>% Visa</td>
<td>0.62</td>
<td>0.65</td>
<td>0.68</td>
<td>0.015</td>
</tr>
<tr>
<td>mean Visa</td>
<td>0.14</td>
<td>0.17</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>CY</td>
<td>0.26</td>
<td>0.35</td>
<td>0.23</td>
<td>0.11</td>
</tr>
<tr>
<td>Cdrop</td>
<td>0.16</td>
<td>0.18</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>wealth</td>
<td>0.04</td>
<td>2.51</td>
<td>2.60</td>
<td>0.13</td>
</tr>
<tr>
<td>( q(\hat{\theta}) )</td>
<td>512</td>
<td>75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Robustness

Benchmark: \[ R^X, \gamma, R^{CC} \] = [1.0375, 0.05, 1.1175]

Aggressive: \[ R^X, \gamma, R^{CC} \] = [1.03, 0.06, 1.10]

Very Aggressive: \[ R^X, \gamma, R^{CC} \] = [1.02, 0.07, 1.09]

<table>
<thead>
<tr>
<th></th>
<th>Benchmark</th>
<th>Aggressive</th>
<th>Very Aggressive</th>
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<tbody>
<tr>
<td>( \exp ) ( \hat \delta )</td>
<td>.857 (.005)</td>
<td>.930 (.001)</td>
<td>.923 (.002)</td>
</tr>
<tr>
<td>( q(\hat \delta, 1) )</td>
<td>512</td>
<td>278</td>
<td>64</td>
</tr>
</tbody>
</table>

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<tr>
<th></th>
<th>Benchmark</th>
<th>Aggressive</th>
<th>Very Aggressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{hyp} ) [ \hat \delta, \hat \beta ]</td>
<td>[.956, .661] (.001), (.012)</td>
<td>[.944, .815] (.001), (.014)</td>
<td>[.932, .909] (.002), (.016)</td>
</tr>
<tr>
<td>( q(\hat \delta, \hat \beta) )</td>
<td>75</td>
<td>45</td>
<td>33</td>
</tr>
<tr>
<td>Statistic</td>
<td>Aggressive</td>
<td>Exponential $m_s(1, \hat{\delta})$</td>
<td>Hyperbolic $m_s(\hat{\beta}, \hat{\delta})$</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------</td>
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<td>-----------------------------------------------</td>
</tr>
<tr>
<td>% Visa</td>
<td>0.44</td>
<td>0.65</td>
<td>0.68</td>
</tr>
<tr>
<td>mean Visa</td>
<td>0.08</td>
<td>0.16</td>
<td>0.12</td>
</tr>
<tr>
<td>CY</td>
<td>0.10</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>Cdrop</td>
<td>0.08</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>wealth</td>
<td>2.50</td>
<td>2.61</td>
<td>2.60</td>
</tr>
<tr>
<td>$q(\hat{\theta})$</td>
<td>278</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>V. Agg.</td>
<td>Exponential Statistic: $m_s(1, \hat{\delta})$</td>
<td>Hyperbolic Statistic: $m_s(\hat{\beta}, \hat{\delta})$</td>
<td>Data statistic: $m_e$</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>% Visa</td>
<td>$\hat{\delta} = .923$</td>
<td>$\hat{\beta} = .909$</td>
<td>$\hat{\delta} = .932$</td>
</tr>
<tr>
<td>mean Visa</td>
<td>$0.58$</td>
<td>$0.65$</td>
<td>$0.68$</td>
</tr>
<tr>
<td>CY</td>
<td>$0.12$</td>
<td>$0.15$</td>
<td>$0.12$</td>
</tr>
<tr>
<td>Cdrop</td>
<td>$0.14$</td>
<td>$0.19$</td>
<td>$0.23$</td>
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<tr>
<td>wealth</td>
<td>$2.53$</td>
<td>$2.66$</td>
<td>$2.60$</td>
</tr>
<tr>
<td>$q(\hat{\theta})$</td>
<td>$64$</td>
<td>$33$</td>
<td></td>
</tr>
</tbody>
</table>
6 Conclusion

- Structural test using the method of simulated moments rejects the exponential discounting null.

- Specification tests reject both the exponential and the hyperbolic models.

- Quantitative results are sensitive to interest rate assumptions.

- Hyperbolic discounting does a better job of matching the available empirical evidence on consumption and savings.